

Weather and Climate

Protocol: Weather and Climate

Parks Where Protocol Will Be Implemented: KATM, KEFJ, LACL, ANIA

Justification/Issues Being Addressed: Climate is a basic driver of all ecological systems. Global climate models predict that climate change and variability will be most severe at high latitudes, and there are many indications that environmental conditions are already changing in these regions.

Accurate, long-term data sets are important for understanding the relationship between climate and other components of biotic and abiotic systems. Without climate data, it is impossible to appreciate the causes of a variety of ecosystem changes—from vegetative cover changes to shifts in aquatic and terrestrial plant and animal communities. Climate is also a fundamental driver for physical processes (fluvial and glacial) on the landscape.

Existing weather stations in southwest Alaska are focused primarily on the safety and needs of the aviation community, the primary form of transportation in this area, and are thus collocated with the sparse human development. Commonly, these stations are sited at lower elevations in broad valleys, or in coastal areas. SWAN parks exhibit extreme topographic and geographic gradients and consequently, climate variability (maritime to continental), most of which is not represented in the current network of weather stations. Deployment of weather stations and the accurate collection of weather observations in remote coastal and mountainous locations will help to fill data gaps that currently exist in SWAN.

Specific Monitoring Questions and Objectives to be Addressed by the Protocol:

Question:

- What is the natural variability in weather (temperature, relative humidity, precipitation, wind) and the long-term climate trends in SWAN parks?

Objectives:

- Record and archive hourly weather observations, including temperature, relative humidity, precipitation, wind speed/direction, solar radiation, relative humidity, and snow depth at weather stations located in representative areas within SWAN parks.
- Produce monthly and annual summaries of weather observations and identify extremes of climatic conditions for common parameters (precipitation and air temperature), and other parameters for which sufficient data are available (e.g., wind speed and direction, solar radiation).

Basic Approach: Strategically deploy a network of remote automated weather stations (RAWS) in SWAN. There are currently > 100 RAWS stations in Alaska, including three in SWAN. Air temperature, relative humidity, soil moisture, wind direction and speed, snow depth, solar radiation, and precipitation are transmitted via NOAA's Geostationary Operational Environmental Satellite (GOES) telemetry. These data are received via a direct-readout ground site in Boise, Idaho, in cooperation with the Bureau of Land Management. RAWS protocols have been developed by numerous parks and will be used, with minor modification, at SWAN. Initial steps will focus on selecting instrumentation and station locations.

Determine the best method for measuring all-season precipitation at sites within SWAN without access to a power grid.

- Evaluate USGS method (propylene glycol/ethanol mix with tipping bucket) on the Harding Icefield weather station.
- Evaluate Central Alaska Network/Natural Resource Conservation Service partnership for SNOTEL storage precipitation gages.

Identify, evaluate, and select potential weather station deployment locations based on their ability to:

- Fill in gaps of the existing network of weather stations.
- Capture average climate and climate variability across the SWAN region.
- Contribute to larger scale climate monitoring and modeling efforts.

Weather station site identification will utilize a combination of tools:

- Site recommendation report prepared by the Western Regional Climate Center (Redmond et al. 2005).
- Knowledge and expertise of park employees (land status, sensitive areas, park needs, access logistics, potential collocation sites such as radio repeater locations and Federal Aviation Administration weathercams).
- PRISM (Program for Integrated Earth System Modeling) data set (temperature and precipitation).
- North Gulf of Alaska coastal wind event modeling (Olsson et al. n.d).

Potential sites will be evaluated through over-flights and on-site evaluation of ground conditions, using photo documentation and a site characteristic evaluation form adapted from the NOAA Climate Reference Network Program. Following field visits, a report evaluating and ranking potential deployment sites will be prepared and submitted to park and Network staff, then peer reviewed by climate experts (National Weather Service, State Climatologist, and others) with Alaskan knowledge and experience in climate monitoring.

Principal Investigators and NPS Lead:

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- Kelly Redmond, Western Regional Climate Center

Development Schedule, Budget, and Expected Interim Products:

- FY2006 Site identification and evaluation. Preparation of site evaluation report and peer review. Final site selection, National Environmental Policy Act (\$20,000).
- FY2007 Draft protocol completed.
- FY2008 Protocol peer review.
Deployment of weather stations for testing (\$10,000).
- FY2009 Full implementation (recurring annual costs) (\$25,000).

Literature Cited:

- Olsson, P. Q., K. P. Volz, and H. Yi. nd. Numerical simulation of coastal wind events in the north Gulf of Alaska. Online. (<http://ams.confex.com/ams/pdfview.cgi?username=62919>). Accessed 5 July 2005.
- Redmond, K. T., D. B. Simeral, and G. D. McCurdy. 2005. Climate monitoring for southwest Alaska national parks: Network design and site selection. Western Regional Climate Center, Desert Research Institute, Reno, NV. Report WRCC 05-01. Great Basin Cooperative Ecosystem Studies Unit Task Agreement J8R07040002.